

## APPARATUS AND A METHOD FOR IMAGING

## TECHNOLOGICAL FIELD

[0001] Embodiments of the present invention relate to imaging. In particular, they relate to imaging using a color separation diffraction grating.

## BACKGROUND

[0002] Many image sensors have light sensitive pixels for sensing red, green and blue light arranged in a Bayer pattern array. Each pixel has a filter which allows one of red, green or blue light to pass. The Bayer pattern array is advantageous in that it enables small image sensors for sensing red, green and blue to be manufactured. However, the Bayer pattern array has several disadvantages, including the following:

- [0003] it is difficult to produce very small color filters that only allow light of a particular color to pass;
- [0004] light sensitivity between the red, green and blue pixels tends to vary;
- [0005] having pixels for sensing different colors close to one another tends to result in color leakage (for example where the electric charge of a pixel for sensing a first color influences the electric charge of an adjacent pixel for sensing a second color);
- [0006] in many implementations, the exposure time and analog gain have to be the same for all pixels in a sensor; and
- [0007] the resolution of the raw image captured is less than "full resolution" since there is only one pixel for sensing one color at a particular location. Missing color components must be obtained using pixel interpolation.

## BRIEF SUMMARY

[0008] According to various, but not necessarily all, embodiments of the invention there is provided an apparatus, comprising: at least one color separation diffraction grating configured to direct different spectral components of incident light in different directions; one or more further diffraction gratings configured to at least partially compensate for dispersion in one or more of the different spectral components of light; and one or more image sensors configured to detect the one or more dispersion compensated spectral components of light.

[0009] According to various, but not necessarily all, embodiments of the invention there is provided a method, comprising: diffracting different spectral components of incident light in different directions; at least partially compensating for dispersion in one or more of the different spectral components of light; and detecting the one or more dispersion compensated spectral components of light.

[0010] According to various, but not necessarily all, embodiments of the invention there is provided an apparatus, comprising: means for diffracting different spectral components of incident light in different directions; means for at least partially compensating for dispersion in one or more of the different spectral components of light; and means for detecting the one or more dispersion compensated spectral components of light.

## BRIEF DESCRIPTION

[0011] For a better understanding of various examples of embodiments of the present invention, reference will now be made by way of example only to the accompanying drawings in which:

[0012] FIG. 1 illustrates a functional schematic of an apparatus;

[0013] FIG. 2 illustrates a flow chart of a method;

[0014] FIG. 3 illustrates a first implementation of the apparatus; and

[0015] FIG. 4 illustrates a second implementation of the apparatus.

## DETAILED DESCRIPTION

[0016] Embodiments of the invention relate to using at least one color separation diffraction grating to separately image different parts of the color spectrum and compensate for dispersion.

[0017] In this regard, the figures illustrate an apparatus 100/101/102, comprising: at least one color separation diffraction grating 10 configured to direct different spectral components 51-53 of incident light 40 in different directions; one or more further diffraction gratings 20-23 configured to at least partially compensate for dispersion in one or more of the different spectral components 51-53 of light; and one or more image sensors 30-33 configured to detect the one or more dispersion compensated spectral components 61-63 of light.

[0018] FIG. 1 illustrates a functional schematic of an apparatus 100. The apparatus 100 may, for example, be the whole or part of any of the following: a mobile telephone, a personal computer, a tablet computer, a personal digital assistant and/or a games console.

[0019] The apparatus 100 illustrated in FIG. 1 comprises at least one color separation diffraction grating 10, one or more further diffraction gratings 20 and one or more image sensors 30. The elements 10, 20, 30 are operationally coupled and any number or combination of intervening elements can exist (including no intervening elements).

[0020] The at least one color separation diffraction grating 10 is configured to direct different spectral components of incident light 51-53 in different directions. The at least one color separation diffraction grating 10 may, for example, be provided on a face/surface of a body such as a plate.

[0021] The one or more further diffraction gratings 20 are configured to at least partially compensate for dispersion in one or more of the different spectral components of light 51-53. In some implementations, the one or more further diffraction gratings 20 may consist of a further color separation diffraction grating. In other implementations, the one or more further diffraction gratings 20 may be or comprise one or more blazed gratings and/or one or more slanted gratings.

[0022] The one or more further diffraction gratings 20 may, for example, be provided on a different face/surface of the body/plate mentioned above. The body may have a length, width and thickness, where the length is the same as or greater than the width, and where the thickness is smaller than the length and the width. The face/surface on which the one or more further diffraction gratings 20 are provided may be separated from the face/surface on which the at least one color separation diffraction grating 10 is provided by the thickness of the body. The at least one color separation diffraction grating 10 may be at least one in-coupling grating of the body